

PRELIMINARY DATA SUMMARY

September 1988

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Michael W. Leffler at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

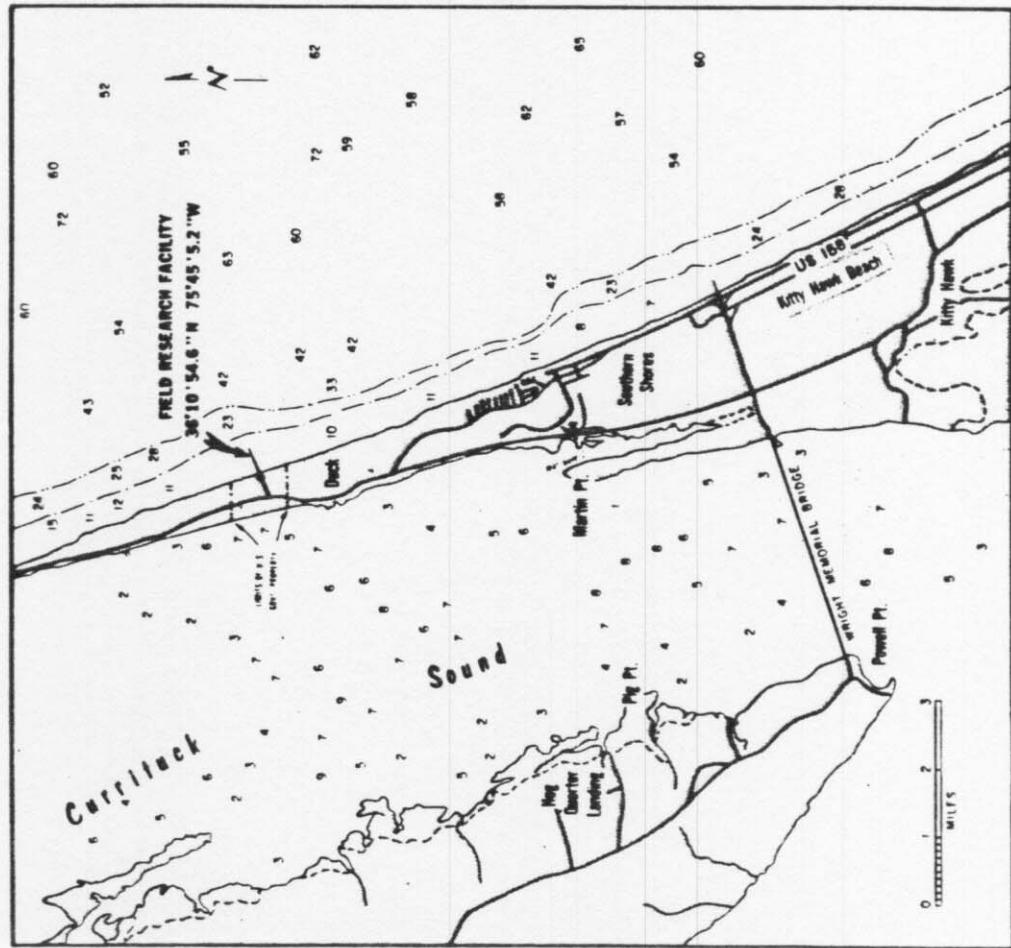
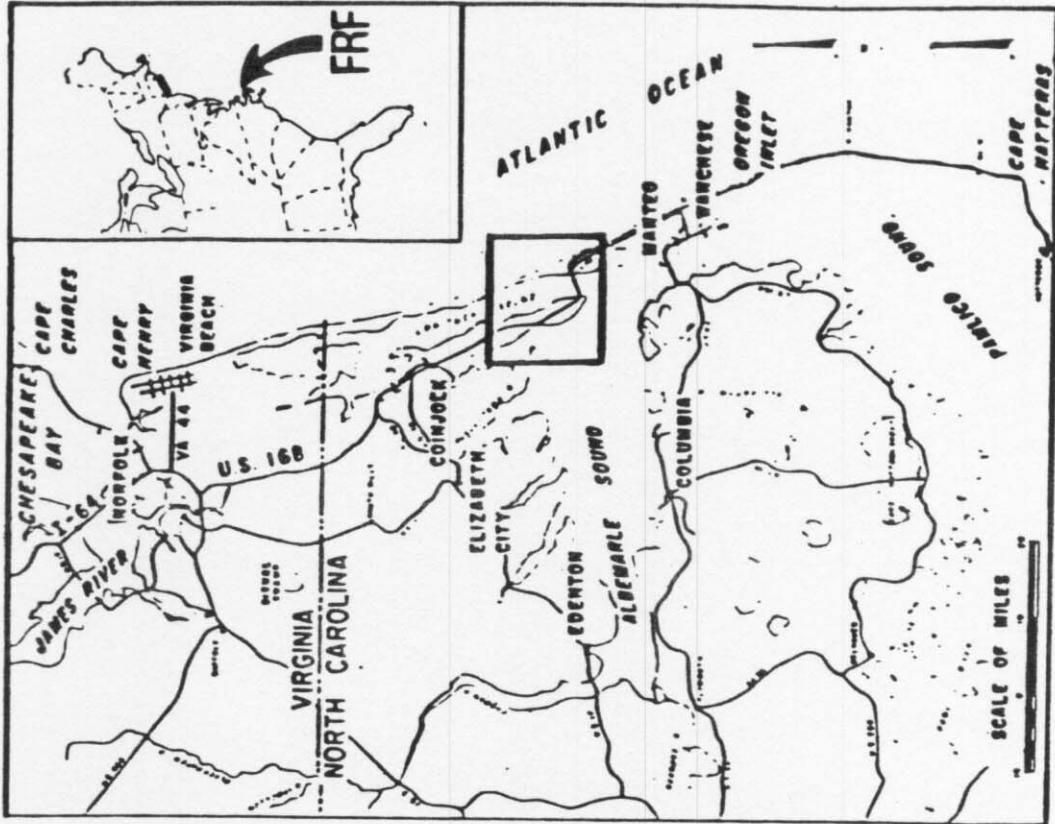


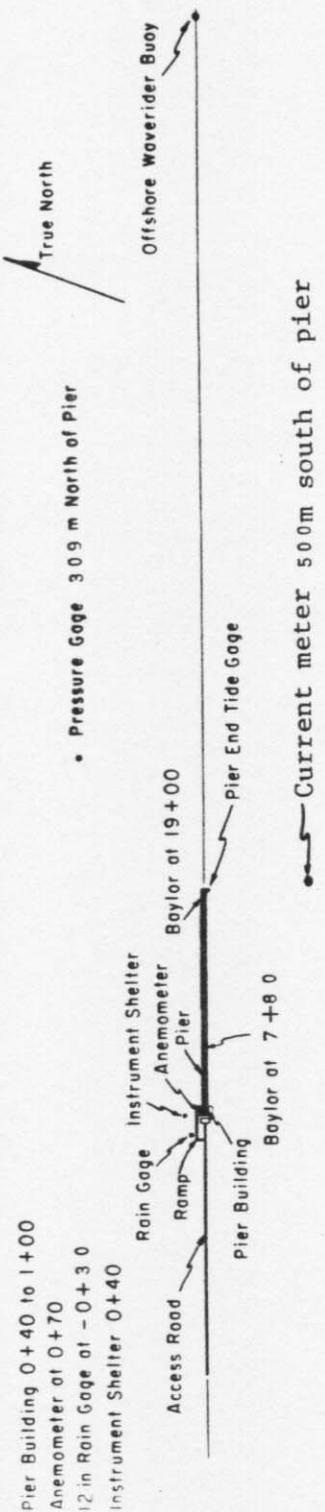
Figure 1. FRF location map

Table 1: Instrument Status/Data Availability

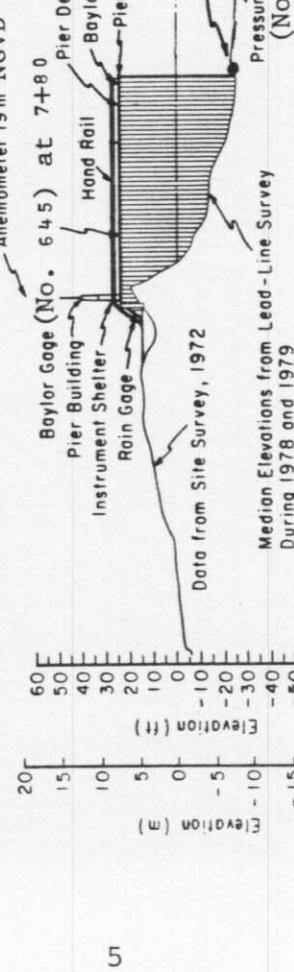
SEP 1988

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																													
				1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
616	Barometric Pressure		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	/	/	*	*	*	*	*	*	*	*	
			Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
604	Precipitation		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	/	/	*	*	*	*	*	*	*	
624	Air Temperature		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	/	/	*	*	*	*	*	*	*		
632	Anemometer on Laboratory Building Elevation 19 m (NGVD)		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	/	/	*	*	*	*	*	*	*		
			Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
645	Baylor staff at station 7+80 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	/	/	*	*	*	*	*	*	*		
625	Baylor staff at station 19+00 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	/	/	*	*	*	*	*	*	*		
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	/	/	*	*	*	*	*	*	*		
630	Waverider buoy 6.0 km offshore	Approx. 23 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	/	/	*	*	*	*	*	*	*		
679	Current meter 500 m south of FRF pier (0.5 km offshore)	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	/	/	*	*	*	*	*	*	*		
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
	Supplemental Observations (daily oceanographic and meteorological observations)		Daily observation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	

Gage Status	Daily Observation	Analog Record	Data Collected
Operational = *	Complete = *	Complete = *	All = *
Partial = /	Partial = /	Partial = /	Partial = /
Non-Operational = -	None = -	None = -	None = -



CURRITUCK SOUND



ATLANTIC OCEAN

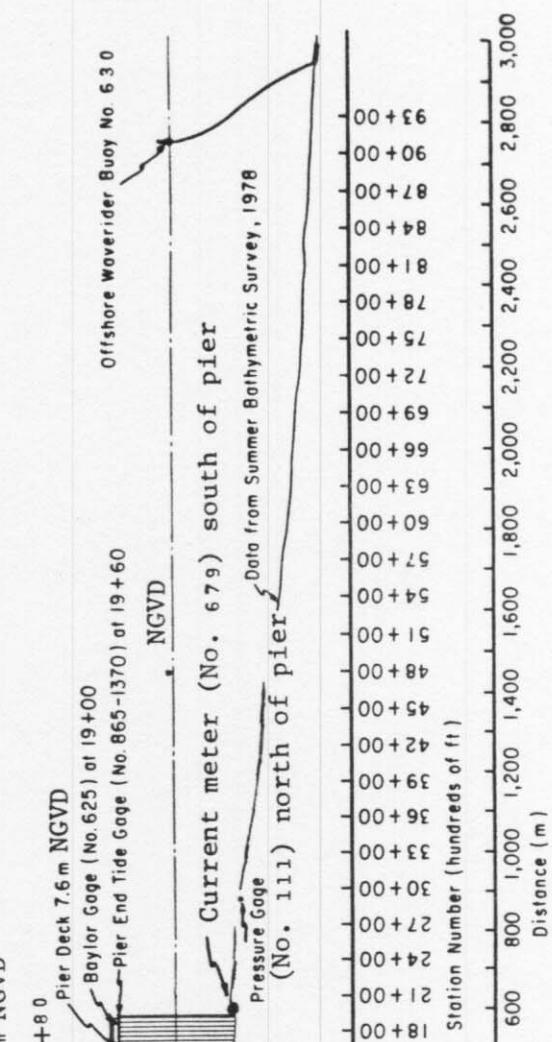


Figure 2. Instrument locations at FRF

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured on top of the laboratory building at an elevation of 19 m (Figure 2) using a Weather Measure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $mm \times .03937 = in.$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $mb \times 0.02953 = in. Hg$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

Table 2: Meteorological Data

SEP 1988

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	11	32	21.5	1021.3	0
	700	11	31	21.5	1020.9	0
	1300	9	30	22.3	1022.3	0
	1900	8	34	21.4	1022.6	0
2	100	9	39	21.7	1021.9	0
	700	7	27	21.3	1021.6	0
	1300	7	20	22.2	1020.6	0
	1900	7	14	21.6	1018.9	0
3	100	4	346	21.0	1017.9	0
	700	4	3	21.5	1017.5	0
	1300	4	52	24.2	1016.2	0
	1900	4	117	21.8	1015.2	0
4	100	3	155	20.9	1013.1	0
	700	5	176	24.5	1010.1	0
	1300	8	194	29.0	1005.4	0
	1900	9	205	24.7	1004.0	0
5	100	10	213	23.1	1002.3	0
	700	6	265	20.3	1002.3	0
	1300	7	234	22.8	1002.0	0
	1900	5	275	22.9	1004.3	0
6	100	4	285	20.3	1006.4	0
	700	11	23	20.1	1009.1	0
	1300	12	16	19.6	1010.8	0
	1900	11	19	18.1	1011.4	0
7	100	10	26	18.7	1013.1	0
	700	12	17	18.3	1015.5	0
	1300	10	11	19.7	1017.2	0
	1900	11	26	18.9	1017.2	0
8	100	12	42	20.1	1016.9	0
	700	13	27	19.5	1016.5	23
	1300	6	102	21.8	1015.9	9
	1900	5	217	21.8	1016.2	0
9	100	1	158	20.2	1016.9	0
	700	0		20.9	1017.2	0
	1300	4	34	21.2	1016.5	0
	1900	4	93	21.8	1015.9	0
10	100	4	186	22.8	1015.2	4
	700	5	268	22.3	1016.5	0
	1300	3	20	23.1	1018.2	0
	1900	0		22.1	1018.2	0
11	100	3	238	21.6	1019.2	0
	700	4	278	21.4	1020.3	0
	1300	5	350	23.1	1021.3	0
	1900	2	62	20.3	1020.9	0
12	100	1	213	18.6	1021.3	0
	700	3	353	20.8	1023.0	0
	1300	3	20	23.1	1021.9	0
	1900	4	97	20.1	1020.6	0
13	100	3	169	18.4	1018.6	0
	700	4	217	21.3	1017.5	0
	1300	7	208	27.0	1013.1	0
	1900	5	200	24.4	1012.1	0
14	100	5	215	23.0	1011.8	0
	700	4	260	23.1	1012.5	0
	1300	8	14	22.0	1013.8	0
	1900	5	47	20.3	1014.8	0
15	100	4	59	19.5	1016.2	0
	700	5	348	20.3	1018.9	0
	1300	9	13	20.9	1021.9	0
	1900	8	32	19.1	1023.0	0
16	100	8	39	19.0	1025.3	0
	700	7	41	19.5	1027.0	0
	1300	5	36	20.7	1027.0	0
	1900	6	57	19.3	1026.0	0

(Continued)

(Sheet 1 of 2)

Table 2: Meteorological Data

SEP 1988

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
17	100	3	51	19.5	1025.7	0
	700	5	73	21.2	1024.0	0
	1300	3	115	23.1	1022.3	0
	1900	3	111	21.1	1020.9	0
18	100	2	118	20.5	1019.6	0
	700	4	84	21.1	1018.9	0
	1300	3	98	24.8	1018.6	0
	1900					0
19	100					0
	700					0
	1300			UPS inoperative		0
	1900					0
20	100					0
	700					0
	1300	5	178		1015.9	0
	1900	6	221		1015.2	0
21	100	6	240		1014.2	0
	700			Electronic problems		0
	1300	4	2	23.8	1013.5	0
	1900	1	30	21.0	1013.5	0
22	100	7	14	20.9	1013.8	0
	700	4	329	19.4	1015.5	0
	1300	5	21	21.1	1014.8	0
	1900	3	77	19.0	1014.2	0
23	100	4	181	19.1	1013.1	0
	700	5	224	21.0	1012.5	0
	1300	7	220	27.8	1009.4	0
	1900	6	206	25.0	1008.7	0
24	100	7	233	23.3	1010.4	0
	700	4	267	22.9	1012.1	0
	1300	6	23	22.1	1013.5	0
	1900	7	70	22.0	1012.8	0
25	100	5	15	22.2	1012.5	0
	700	8	341	20.3	1013.1	0
	1300	5	3	22.5	1014.2	0
	1900	6	359	19.8	1014.8	0
26	100	9	357	18.9	1015.9	0
	700	10	10	18.7	1017.5	0
	1300	9	3	19.3	1018.6	0
	1900	9	27	19.1	1019.2	0
27	100	9	35	19.5	1019.2	0
	700	9	35	20.0	1020.3	0
	1300	8	23	21.9	1020.6	0
	1900	6	20	20.4	1019.6	0
28	100	4	37	20.3	1019.2	0
	700	5	355	20.8	1019.9	0
	1300	5	21	23.1	1019.9	0
	1900	5	46	20.8	1020.6	0
29	100	4	37	20.5	1021.6	0
	700	8	37	20.9	1023.3	0
	1300	7	7	23.2	1024.0	0
	1900	9	45	20.9	1024.0	0
30	100	10	45	20.3	1024.3	0
	700	9	38	20.3	1025.0	0
	1300	6	28	21.6	1024.3	0
	1900	5	34	19.7	1023.6	0
		Resultant 3		Mean 21.3	Mean 1016.9	Total 36

(Sheet 2 of 2)

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hrs (more frequently during storms) near 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for 34 minutes.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

Table 3: Wave Data

Sep 1988

Day	Hour	645		625		111		630	
		Baylor at 7+80 Hmo,m	T,sec	Baylor at 19+00 Hmo,m	T,sec	Pressure Gage Hmo,m	T,sec	Farshr Wvrdr Hmo,m	T,sec
1	0100	1.07	5.95	1.61	5.95	1.68	6.24	1.82	6.56
	0700	1.12	6.56	1.57	9.48	1.61	6.74	1.71	5.69
	1300	1.01	5.12	1.59	6.24	1.63	9.48	1.63	5.69
	1900	0.64	4.66	1.12	7.31	1.11	8.00	1.16	8.00
2	0100	1.02	5.95	1.43	6.92	1.59	5.82	1.64	6.74
	0700	0.80	5.22	1.29	7.76	1.36	6.92	1.44	6.24
	1300	0.78	5.02	1.25	8.83	1.26	8.83	1.31	7.53
	1900	0.64	4.66	1.12	7.31	1.11	8.00	1.16	8.00
3	0100	0.56	5.45	0.89	7.76	0.89	8.53	0.99	7.76
	0700	0.53	5.57	0.81	8.83	0.89	8.53	0.95	7.53
	1300	0.49	7.76	0.78	8.00	0.81	8.53	0.87	7.11
	1900	0.32	8.53	0.62	8.26	0.69	8.53	0.71	6.74
4	0100	0.33	8.53	0.62	8.53	0.68	8.26	0.78	8.00
	0700	0.37	9.48	0.69	8.83	0.69	9.14	0.82	8.83
	1300	0.37	9.48	0.63	9.14	0.66	9.14	0.97	8.53
	1900	0.29	10.24	0.57	10.24	0.66	10.24	0.80	9.85
5	0100	0.38	9.85	0.64	10.24	0.70	9.85	0.87	9.85
	0700	0.32	9.85	0.48	9.85	0.60	10.24	0.77	9.85
	1300	0.29	8.26	0.47	9.85	0.57	9.85	0.75	7.11
	1900	0.26	8.83	0.43	8.26	0.51	9.85	0.63	9.48
6	0100	0.29	8.83	0.44	8.83	0.46	9.85	0.61	9.14
	0700	1.20	5.69	1.45	5.45	1.51	5.22	1.67	5.33
	1300	1.38	6.92	1.81	6.74	1.92	6.24	1.96	6.56
	1900	1.31	6.92	1.49	6.74	1.48	6.74	1.71	6.40
7	0100	1.13	6.09	1.35	6.40	1.40	6.24	1.49	6.09
	0700	1.20	5.57	1.42	5.57	1.42	5.57	1.64	5.69
	1300	1.07	5.02	1.21	5.57	1.28	5.02	1.38	5.45
	1900	1.11	5.69	1.28	5.95	1.38	4.66	1.49	5.69
8	0100	1.07	5.45	1.43	5.33	1.48	5.45	1.61	5.22
	0700	1.24	5.69	1.91	6.74	2.01	6.24	2.12	6.56
	1300	1.11	5.69	1.48	7.76	1.48	6.74	1.61	6.40
	1900	0.70	7.53	0.99	7.31	1.05	7.11	1.17	7.11
9	0100	0.62	6.74	0.83	7.76	0.98	7.11	0.95	7.53
	0700	0.49	14.22	0.81	6.40	0.79	6.24	0.88	6.40
	1300	0.38	13.47	0.65	13.47	0.65	13.47	0.69	6.24
	1900	0.40	12.80	0.60	12.80	0.63	13.47	0.65	12.80
10	0100	0.36	12.19	0.57	12.19	0.64	12.80	0.69	12.19
	0700	0.32	12.19	0.50	12.80	0.51	12.19	0.65	12.80
	1300	0.30	12.19	0.47	12.19	0.46	11.64	0.50	12.19
	1900	0.34	12.19	0.47	10.24	0.48	12.19	0.58	7.31
11	0100	0.32	12.19	0.36	12.19	0.42	11.64	0.44	6.74
	0700	0.23	9.85	0.36	12.19	0.41	12.19	0.41	9.85
	1300	0.25	11.64	0.35	12.19	0.38	10.67	0.46	11.13
	1900	0.40	4.41	0.48	4.34	0.52	11.13	0.57	7.53
12	0100	0.44	5.22	0.43	9.48	0.49	10.24	0.52	10.24
	0700	0.45	5.12	0.56	9.48	0.59	8.53	0.69	5.02
	1300	0.47	5.12	0.58	9.85	0.67	9.85	0.67	9.48
	1900	0.38	4.57	0.56	9.14	0.62	9.85	0.64	9.14
13	0100	0.38	5.45	0.57	9.14	0.63	9.48	0.64	9.14
	0700	0.32	9.48	0.54	9.48	0.60	9.48	0.68	9.14
	1300	0.28	9.85	0.47	9.85			0.67	9.48
	1900	0.28	9.14	0.48	9.14		Gage	0.62	9.48
14	0100	0.25	9.85	0.37	9.85		Inoperative	0.55	10.24
	0700	0.23	13.47	0.38	9.48			0.52	9.14
	1300	0.83	4.20	0.88	4.34			0.88	4.41
	1900	0.72	5.22	0.72	5.22	0.75	5.12	0.83	8.83
15	0100	0.58	5.82	0.63	8.83	0.63	9.14	0.78	8.53
	0700	0.55	5.45	0.63	9.48	0.58	11.64	0.71	8.83
	1300	0.81	4.83	0.94	4.92	0.91	4.57	1.08	4.74
	1900	0.97	5.57	1.00	5.57	0.98	5.57	1.10	5.45
16	0100	0.95	6.09	0.93	5.95	0.91	6.74	1.05	6.09
	0700	0.87	5.95	0.89	5.95	0.94	5.95	1.01	5.69
	1300	0.75	5.69	0.82	6.24	0.83	6.40	0.91	5.45
	1900	0.63	5.33	0.71	5.45	0.70	6.09	0.78	5.57

* Electronic problems

(Continued)

(Sheet 1 of 2)

Table 3: Wave Data

Sep 1988

Day	Hour	645		625		111		630	
		Baylor	at 7+80	Baylor	at 19+00	Pressure	Gage	Farshr	Wvrdr
		Hmo,m	T,sec	Hmo,m	T,sec	Hmo,m	T,sec	Hmo,m	T,sec
17	0100	0.64	5.95	0.68	5.82	0.69	5.95	0.74	5.95
	0700	0.57	5.57	0.66	5.33	0.70	5.45	0.72	5.22
	1300	0.50	6.24	0.62	7.76	0.62	6.74	0.68	6.92
	1900	0.36	5.33	0.54	7.11	0.58	6.09	0.62	5.95
18	0100	0.34	5.12	0.50	7.76	0.55	7.11	0.58	6.74
	0700	0.28	5.12	0.44	6.56	0.49	6.40	0.56	5.57
	1300	0.30	6.09	0.47	5.02	0.53	5.22	0.60	5.57
	1900								
19	0100								
	0700								
	1300								
	1900								
20	0100								
	0700								
	1300	0.25	8.53	0.39	8.53	0.43	8.83	0.52	8.53
	1900	0.24	7.31	0.39	8.00	0.45	8.26	0.53	7.53
21	0100	0.23	7.53	0.36	8.26	0.42	8.00	0.50	8.26
	0700								
	1300	0.27	7.11	0.43	7.11	0.51	7.11	0.57	7.31
	1900	0.24	8.83	0.40	7.11	0.42	7.11	0.51	7.53
22	0100	0.30	2.75	0.42	7.31	0.38	7.11	0.54	7.76
	0700	0.58	4.13	0.63	4.27	0.70	4.20	0.77	4.20
	1300	0.86	5.45	0.88	5.45	0.93	5.57	0.96	5.22
	1900	0.56	5.69	0.54	5.22	0.56	5.33	0.69	5.33
23	0100	0.47	5.95	0.45	6.09	0.51	9.48	0.56	5.95
	0700	0.28	5.45	0.33	9.48	0.37	9.14	0.40	9.14
	1300	0.18	8.83	0.28	9.48	0.34	9.48	0.40	8.26
	1900	0.20	3.61	0.32	9.14	0.31	9.85	0.40	9.48
24	0100	0.15	9.48	0.22	8.53	0.28	8.83	0.36	2.10
	0700	0.14	13.47	0.22	8.83	0.25	8.83	0.29	9.14
	1300	0.97	5.02	0.91	4.74	0.83	4.92	0.95	4.83
	1900	1.01	6.24	0.93	5.82	0.90	6.09	1.06	6.24
25	0100	0.92	6.09	0.78	6.09	0.81	6.24	0.91	5.82
	0700	1.07	6.40	0.95	5.82	0.92	6.56	0.96	5.82
	1300	1.13	6.56	1.21	6.40	1.23	6.56	1.23	6.40
	1900	1.19	7.31	1.11	7.76	1.10	7.53	1.27	7.31
26	0100	1.08	7.11	1.14	7.11	1.11	7.11	1.23	6.92
	0700	1.26	5.82	1.28	5.02	1.26	5.57	1.36	5.22
	1300	1.08	5.57	1.29	6.40	1.35	5.95	1.30	6.09
	1900	1.14	6.09	1.28	6.74	1.26	6.09	1.34	6.56
27	0100	0.99	5.45	1.18	6.40	1.18	6.24	1.19	5.12
	0700	1.01	5.33	1.26	13.47	1.26	14.22	1.24	5.57
	1300	1.00	14.22	1.32	14.22	1.34	14.22	1.38	8.26
	1900	0.81	14.22	1.20	13.47	1.33	13.47	1.29	13.47
28	0100	0.75	14.22	1.05	13.47	1.21	13.47	1.11	12.80
	0700	0.76	12.80	1.09	12.19	1.19	12.80	1.21	12.80
	1300	0.74	15.06	1.16	14.22	1.20	15.06	1.48	16.00
	1900	0.73	16.00	1.05	16.00	1.16	15.06	1.16	13.47
29	0100	0.62	14.22	0.96	15.06	1.01	11.64	1.02	15.06
	0700	0.69	15.06	0.99	14.22	1.01	11.64	1.09	14.22
	1300	0.69	15.06	1.03	14.22	1.18	14.22	1.09	11.13
	1900	1.24	7.53	1.61	7.31	1.60	7.53	1.74	7.53
30	0100	1.22	8.26	1.59	8.53	1.75	8.00	1.67	8.53
	0700	1.17	7.31	1.54	8.53	1.60	8.83	1.65	8.53
	1300	0.85	6.92	1.16	8.83	1.26	8.26	1.27	7.53
	1900	0.66	5.12	0.99	8.83	1.10	8.53	1.04	8.53
Mean		0.65	7.78	0.84	8.41	0.89	8.40	0.96	7.81
Std dev		0.34	3.14	0.40	2.69	0.42	2.73	0.41	2.50

* Electronic problems

(Sheet 2 of 2)

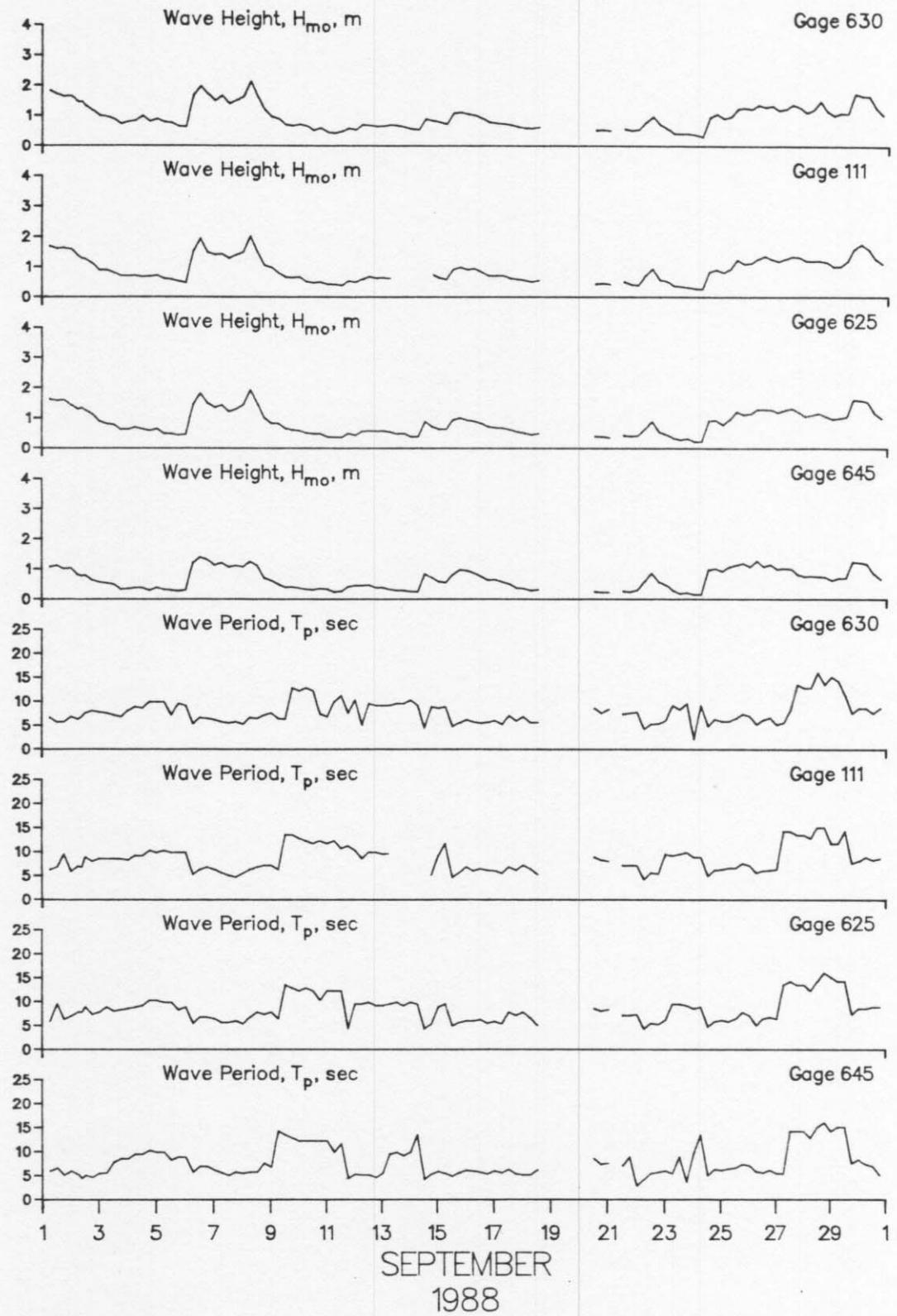


Figure 3. Time history of wave heights and periods

PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

Table 4: Current Data
Sep 1988

Alongshore Cross-shore Resultant Time	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter at South Tripod			
	Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	Depth -4.8m (NGVD)	ID #679
Day												Speed	Dir
1 0100-Along Cross Result													
1 0700-Along Cross Result	18 6 19	S on 177		18 22 28	S on 210			105	S	19 1 19	S off 157		
1 1300-Along Cross Result												17 2 17	S off 153
1 1900-Along Cross Result												11 0 11	S 160
2 0100-Along Cross Result												19 1 19	S off 157
2 0700-Along Cross Result	10 2 10	S on 171		25 51 57	N on 277			63	S	10 0 10	S 160		
2 1300-Along Cross Result												16 0 16	S 160
2 1900-Along Cross Result												13 1 13	S on 164
3 0100-Along Cross Result												11 3 11	S off 145
3 0700-Along Cross Result	21 0 21	S 177 160		29 0 29	S 160			40	S	18 1 18	S on 163		
3 1300-Along Cross Result												11 0 11	S 160
3 1900-Along Cross Result												16 3 16	S off 149
4 0100-Along Cross Result												10 1 10	S on 166
4 0700-Along Cross Result	24 15 28	N off 11		61 0 61	N 340			49	N	7 2 7	S on 176		
4 1300-Along Cross Result												2 7 7	N on 266
4 1900-Along Cross Result												2 7 7	N on 266
5 0100-Along Cross Result												8 7 11	N on 299
5 0700-Along Cross Result	11 9 14	N off 22		68 0 68	N 340			37	N	5 5 7	N on 295		
5 1300-Along Cross Result												6 4 7	N on 306
5 1900-Along Cross Result												3 3 4	N off 25

KEY = All speeds in CM/SEC
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Sep 1988

Alongshore Cross-shore Resultant Time	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter at South Tripod		
	Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)		Distance from Baseline (m)		Dye 12m offshore (surface)		Location	Speed	Dir	Depth -4.8m (NGVD)
Day	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir		
6 0100-Along Cross Result											2	N
6 0700-Along Cross Result	32	S			87	S			49	S	28	S
	2	off			26	on					3	off
	32	157	177		91	177					28	154
6 1300-Along Cross Result											32	S
											3	off
6 1900-Along Cross Result											32	155
											30	S
											3	off
											30	154
7 0100-Along Cross Result											24	S
											1	off
											24	158
7 0700-Along Cross Result	51	S			68	S			27	S	36	S
	13	on	177		0						3	off
	52	174			68	160					36	155
7 1300-Along Cross Result											25	S
											1	on
7 1900-Along Cross Result											25	162
											32	S
8 0100-Along Cross Result											0	
											32	160
8 0700-Along Cross Result	55	S			0				24	S	21	S
	33	on	189		0						1	off
	65	191			0	0					32	158
8 1300-Along Cross Result											18	S
											0	
8 1900-Along Cross Result											18	160
											13	S
											9	on
											16	195
9 0100-Along Cross Result											15	S
											1	on
											15	164
9 0700-Along Cross Result	23	S			32	N			24	N	16	S
	0				5	off					5	off
	23	160	152		32	349					17	143
9 1300-Along Cross Result											16	S
											1	off
9 1900-Along Cross Result											16	156
											9	S
											2	on
											9	173
10 0100-Along Cross Result											5	S
											3	on
											6	191
10 0700-Along Cross Result	38	S			18	S			0		9	S
	2	off	156		6	off					3	on
	38	157			19	141					9	178
10 1300-Along Cross Result											12	S
											5	off
10 1900-Along Cross Result											13	137
											5	N
											1	on
											5	329

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Sep 1988

Alongshore Cross-shore Resultant ---- Time	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	Speed	Dir
Day	Speed	Dir									
11 0100-Along Cross Result										0	
11 0700-Along Cross Result	12 3 13	S off 146		9 5 10	S off 129			17	N	5 5 4	on 250 S
11 1300-Along Cross Result										1 3 17	off 174 S
11 1900-Along Cross Result										6 1 6	S on 169
12 0100-Along Cross Result										3 1 3	S on 178
12 0700-Along Cross Result	18 0 18	S 160		0 0 0				12	N	7 1 7	S on 168
12 1300-Along Cross Result										14 4 15	off 144 S
12 1900-Along Cross Result										8 5 9	off 128 S
13 0100-Along Cross Result										4 2 4	off 133 S
13 0700-Along Cross Result	19 10 22	N off 9		38 4 38	N off 346			6	N	6 3 7	N on 313
13 1300-Along Cross Result										7 5 9	N on 304
13 1900-Along Cross Result										10 4 11	N on 318
14 0100-Along Cross Result										0 1 1	on 250 S
14 0700-Along Cross Result	0 0 0			12 4 12	N off 359			14	N	0 1 1	off 70 N
14 1300-Along Cross Result										12 9 15	off 123 S
14 1900-Along Cross Result										3 5 6	off 101 N
15 0100-Along Cross Result										1 5 5	on 261 N
15 0700-Along Cross Result	17 5 18	S on 177		0 0 0				30	S	0 0 0	
15 1300-Along Cross Result										18 3 18	S off 151
15 1900-Along Cross Result										13 1 13	S off 156

KEY = All speeds in CM/SEC
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Sep 1988

Day	Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod			
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir
16 0100-Along Cross Result											13	S
16 0700-Along Cross Result	30 18 36	S on 191			44 9 44	S on 171			50 North	S	1 13 13	off 156 151
16 1300-Along Cross Result											20 4 20	S off 149
16 1900-Along Cross Result											14 1 14	S off 156
17 0100-Along Cross Result											12 4 13	S off 142
17 0700-Along Cross Result	13 6 15	S on 184			0 0 0				8 North	S	4 5 6	S off 109
17 1300-Along Cross Result											10 2 10	S on 171
17 1900-Along Cross Result											1 0 1	S off 160
18 0100-Along Cross Result											0 3 3	on 250
18 0700-Along Cross Result	38 8 39	N on 329			38 11 40	N on 323			18 South	N	6 1 6	N on 331
18 1300-Along Cross Result											3 1 3	N off 358
18 1900-Along Cross Result												
19 0100-Along Cross Result												
19 0700-Along Cross Result	8 2 8	N on 326			51 0 51	N 340			20 South	N		
19 1300-Along Cross Result												
19 1900-Along Cross Result												
20 0100-Along Cross Result												
20 0700-Along Cross Result	27 8 28	N off 357			68 10 68	N off 349			32 South	N		
20 1300-Along Cross Result											0 3 3	on 250
20 1900-Along Cross Result											1 3 3	S on 232

KEY = All speeds in CM/SEC
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Table 4: Current Data (Continued)
Sep 1988

Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter at South Tripod	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	Depth -4.8m (NGVD)	ID #679
Day	Speed	Dir							Speed	Dir
21 0100-Along Cross Result									0	
21 0700-Along Cross Result	0				36	N			3	on
	12	off	177		16				3	250
	12	70			39	4				
21 1300-Along Cross Result									7	N
									6	off
21 1900-Along Cross Result									9	21
									2	S
22 0100-Along Cross Result									3	on
									4	216
22 0700-Along Cross Result	32	S			51	S			6	S
	5	off	165		0				0	
	32	151			51	160			6	160
22 1300-Along Cross Result									19	
									6	off
22 1900-Along Cross Result									20	142
									9	S
23 0100-Along Cross Result									10	off
									13	112
23 0700-Along Cross Result	0				27	N			4	S
	15	off	177		12				3	on
	15	70			29	4			5	197
23 1300-Along Cross Result									11	S
									2	off
23 1900-Along Cross Result									11	150
									5	
24 0100-Along Cross Result									5	S
									1	on
24 0700-Along Cross Result	47	S			41	S			5	171
	28	on	152		20				8	N
	55	191			45	187			2	on
24 1300-Along Cross Result									8	326
									14	
24 1900-Along Cross Result									3	268
									5	
25 0100-Along Cross Result									2	N
									5	on
25 0700-Along Cross Result	68	S			44	S			5	272
	0		165		13				10	
	68	160			45	177			10	149
25 1300-Along Cross Result									12	S
									8	off
25 1900-Along Cross Result									14	126
									14	
									8	S
									16	130
									6	
									5	off
									8	120
									20	
									2	off
									20	154
									14	
									2	off
									14	152
									23	
									4	off
									23	150

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
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on = onshore off = offshore

Table 4: Current Data (Concluded)
Sep 1988

Alongshore Cross-shore Resultant ---- Time	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter at South Tripod	
	Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)				Dye 12m offshore (surface)		Depth -4.8m (NGVD) ID #679		
Day	Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Speed	Dir	
26 0100-Along Cross Result				51	S				21	S	
	61	S		15	on				1	off	
	34	on	175	53	177	North	35	S	21	157	
	70	189							26		
									3	off	
26 0700-Along Cross Result									26	153	
									21	S	
26 1300-Along Cross Result									3	off	
									21	152	
26 1900-Along Cross Result									18	S	
									2	off	
									18	154	
27 0100-Along Cross Result									13	S	
									2	off	
									13	151	
27 0700-Along Cross Result	11	S		18	S				14	S	
	9	on	152	2	on				3	off	
	14	199		19	166	North	21	N	14	148	
27 1300-Along Cross Result									15	S	
									7	off	
27 1900-Along Cross Result									17	135	
									9	S	
									1	off	
									9	154	
28 0100-Along Cross Result									11	S	
									2	off	
									11	150	
28 0700-Along Cross Result	16	S		38	N				2	S	
	0	on	152	46	on				2	off	
	16	160		60	290	South	58	N	3	115	
28 1300-Along Cross Result									7	S	
									5	off	
28 1900-Along Cross Result									9	124	
									5	S	
									0		
									5	160	
29 0100-Along Cross Result									7	S	
									2	off	
									7	144	
29 0700-Along Cross Result	29	S		23	N				10	S	
	9	on	152	21	on				1	on	
	30	177		32	298	South	13	N	10	166	
29 1300-Along Cross Result									30	S	
									4	off	
29 1900-Along Cross Result									30	152	
									20	S	
									0		
									20	160	
30 0100-Along Cross Result									22	S	
									4	off	
									22	150	
30 0700-Along Cross Result	10	S		13	S				15	S	
	3	on	152	11	on				3	off	
	10	177		17	202	North	32	N	15	149	
30 1300-Along Cross Result									15	S	
									3	off	
30 1900-Along Cross Result									15	149	
									10	S	
									4	off	
									11	138	

KEY = All speeds in CM/SEC
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PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves). The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

Sep 1988

Day	Time	Wave Approach Angle at Pier End		Radar Wave Angle deg from True N	Width of Surf Zone, m	Water Characteristics at Pier End		
		Primary	Secondary			Temp., C	Density g/cc	Secchi Vis., m
1	0725	65		65	73	20.0	1.0224	2.4
2	0741	65		90	49	21.1	1.0220	1.5
3	0805	50		40	49	22.2	1.0210	1.2
4	0755	95		95	24	21.7	1.0218	3.0
5	0726	110			30	22.2	1.0244	1.8
6	0609	30		30	61	21.7	1.0248	1.5
7	0649	30		30	49	19.4	1.0254	1.2
8	0723	30		30	98	20.6	1.0218	0.9
9	0633	80			8	21.1	1.0216	2.7
10	0851	none visible		50	16	21.1	1.0226	2.4
11	0739	65			12	21.1	1.0236	3.7
12	0705	30		30	5	22.2	1.0224	5.2
13	0730	80			14	22.2	1.0228	4.9
14	0719	none visible			24	21.7	1.0232	1.5
15	0727	35		50	24	22.2	1.0244	3.7
16	0704	55		50	85	21.7	1.0228	3.0
17	0747	60		50	37	21.7	1.0226	3.0
18	0911	90		100	16	22.2	1.0220	5.2
19	0746	95		inoperative	12	22.8	1.0222	5.5
20	0737	80		inoperative	43	21.7	1.0230	3.4
21	0726	80		105	24	20.0	1.0246	1.8
22	0732	30		45	24	21.1	1.0242	3.0
23	0733	70			49	21.7	1.0228	2.4
24	0923	20		60	6	22.2	1.0248	4.9
25	0900	30		50	55	22.2	1.0232	2.4
26	0728	45		45	61	21.7	1.0232	1.8
27	0706	50		55	67	21.7	1.0220	2.1
28	0708	60		55	24	21.7	1.0220	1.5
29	0710	60		55	49	22.2	1.0220	1.2
30	0712	60		65	85	22.2	1.0230	0.9

PART VI: WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

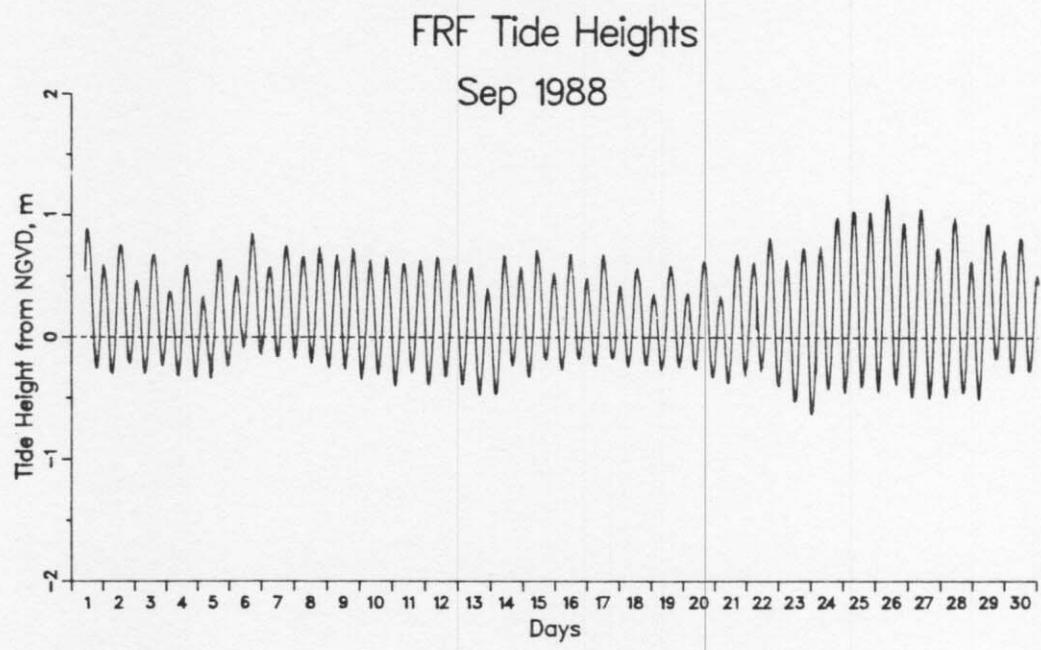


Figure 4. Water level time history

Monthly Water Levels, m NGVD

Extreme Low	=	-0.62 on day 23 at 2300 hr
Extreme High	=	1.18 on day 26 at 700 hr
Monthly Mean	=	0.19
Mean Low	=	-0.31
Mean High	=	0.68
Mean Range	=	0.99

Table 6: Water Levels, m NGVD

		Sep 1988			
Mid-Cycle Day	Time	Low	High	Mean	Range
1	1500	-0.25	0.89	0.30	1.14
2	325	-0.30	0.60	0.16	0.90
2	1551	-0.22	0.76	0.26	0.97
3	416	-0.30	0.47	0.10	0.76
3	1641	-0.24	0.68	0.23	0.91
4	506	-0.32	0.38	0.06	0.69
4	1731	-0.33	0.59	0.14	0.92
5	557	-0.34	0.34	0.02	0.67
5	1822	-0.24	0.64	0.21	0.87
6	647	-0.09	0.50	0.21	0.59
6	1912	-0.14	0.85	0.36	0.99
7	737	-0.16	0.58	0.21	0.74
7	2003	-0.17	0.75	0.31	0.92
8	828	-0.21	0.66	0.24	0.87
8	2053	-0.25	0.74	0.24	0.99
9	918	-0.26	0.68	0.21	0.94
9	2143	-0.34	0.73	0.19	1.07
10	1009	-0.30	0.63	0.16	0.94
10	2234	-0.40	0.66	0.13	1.06
11	1059	-0.29	0.61	0.17	0.89
11	2324	-0.39	0.63	0.12	1.02
12	1149	-0.32	0.66	0.17	0.98
13	15	-0.39	0.60	0.10	0.98
13	1240	-0.47	0.57	0.04	1.04
14	105	-0.47	0.42	-0.01	0.89
14	1330	-0.23	0.67	0.21	0.91
15	155	-0.32	0.58	0.14	0.90
15	1420	-0.18	0.72	0.24	0.91
16	246	-0.27	0.55	0.15	0.81
16	1511	-0.18	0.69	0.22	0.86
17	336	-0.23	0.61	0.14	0.84
17	1601	-0.18	0.68	0.20	0.86
18	426	-0.24	0.52	0.11	0.76
18	1652	-0.23	0.57	0.15	0.80
19	517	-0.27	0.48	0.07	0.75
19	1742	-0.24	0.59	0.15	0.83
20	607	-0.26	0.47	0.08	0.73
20	1832	-0.33	0.63	0.14	0.96
21	658	-0.37	0.40	0.02	0.78
21	1923	-0.31	0.69	0.20	1.00
22	748	-0.27	0.62	0.19	0.89
22	2013	-0.40	0.82	0.20	1.22
23	838	-0.52	0.64	0.06	1.16
23	2104	-0.62	0.73	0.07	1.36
24	929	-0.43	0.75	0.17	1.18
24	2154	-0.45	0.99	0.29	1.44
25	1019	-0.41	1.04	0.33	1.44
25	2244	-0.44	1.03	0.31	1.47
26	1110	-0.38	1.18	0.39	1.56
26	2335	-0.48	0.94	0.24	1.42
27	1200	-0.49	1.06	0.27	1.55
28	25	-0.49	0.73	0.15	1.22
28	1250	-0.45	0.99	0.23	1.44
29	116	-0.50	0.63	0.09	1.13
29	1341	-0.18	0.93	0.36	1.11
30	206	-0.28	0.72	0.22	1.01
30	1431	-0.28	0.82	0.25	1.10
31	256	0.28	0.51	0.44	0.23

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in August and the one survey in September on profile line 188, located 517 m south of the pier. This survey shows a small nearshore bar (200 m) reforming and a small amount of erosion on the foreshore (80 to 120 m).

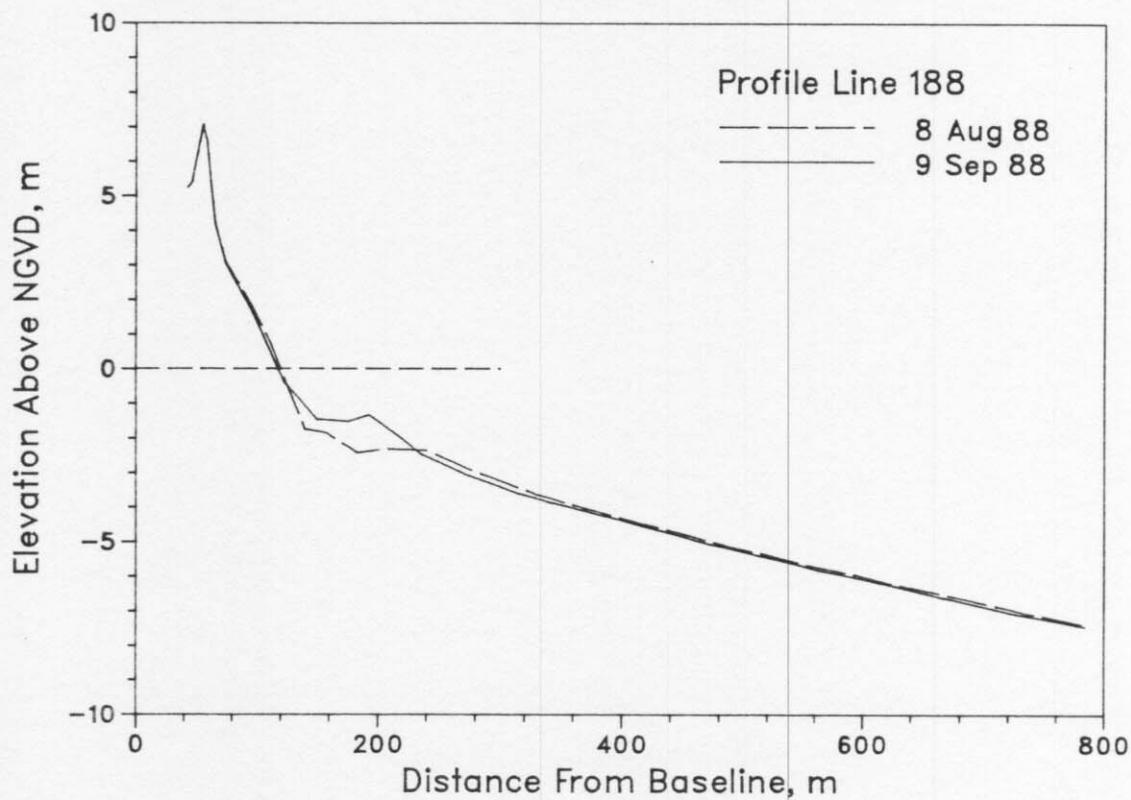


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1988. Two minor changes to the envelope (140 and 200 m) are a result of the reformation of the nearshore bar.

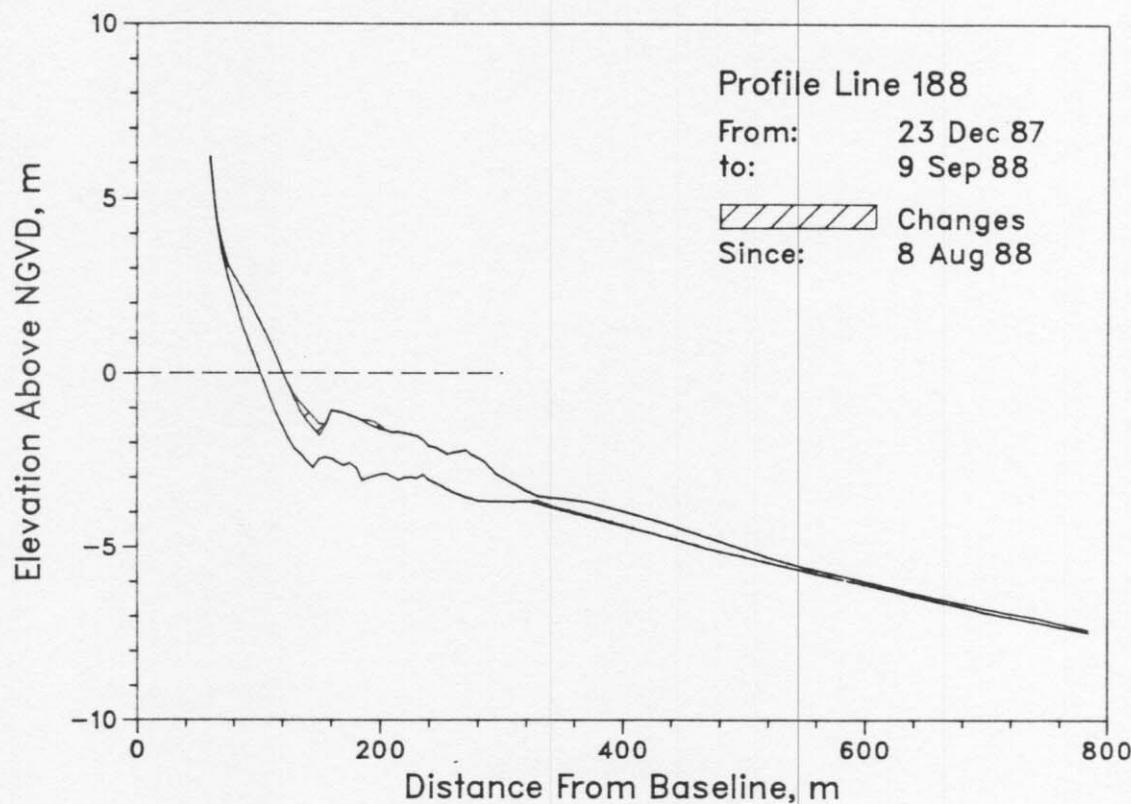


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey conducted on 9 September. Wide contour lines on the change diagram represent areas which eroded; thin lines indicate accretion.

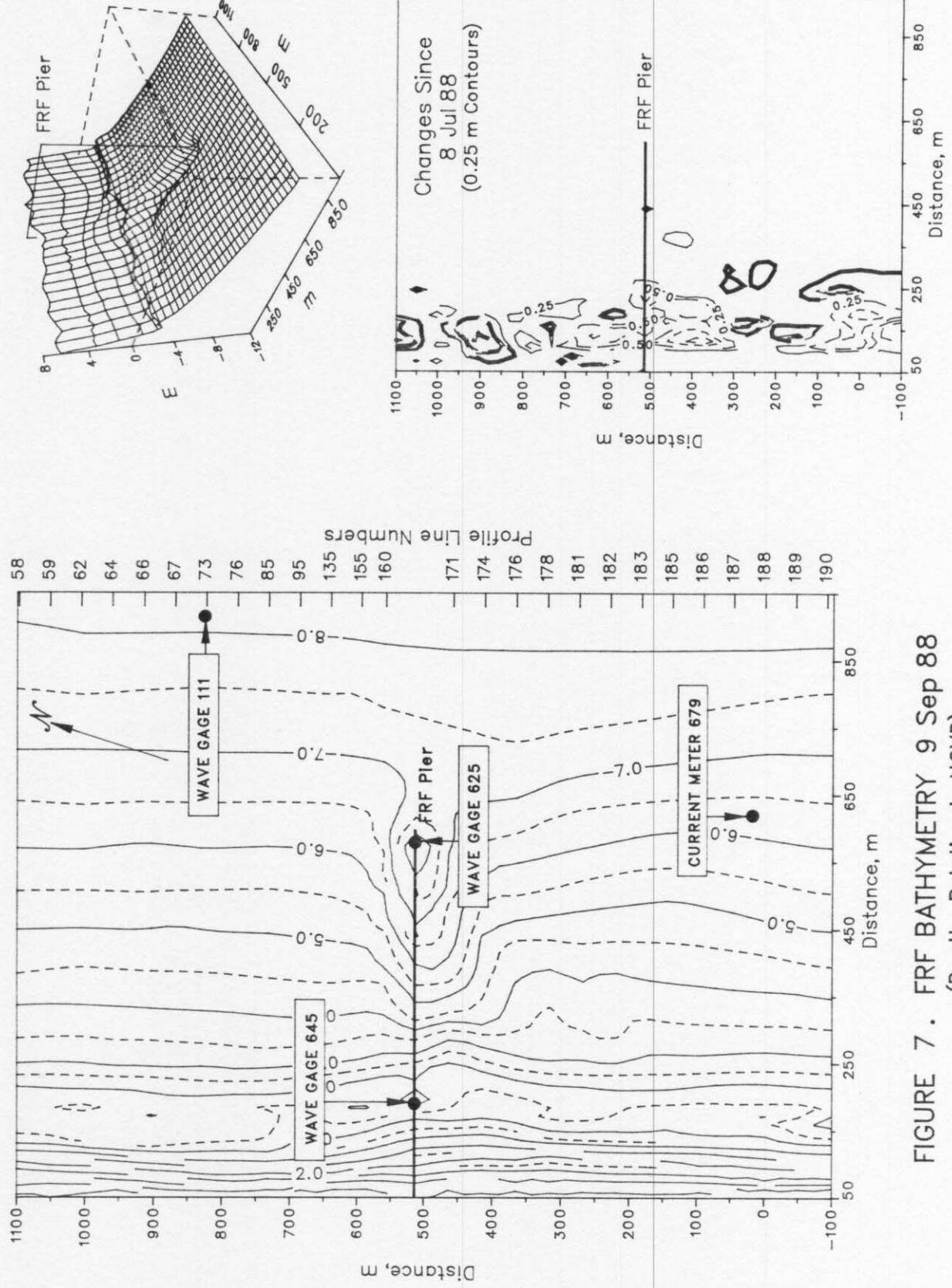


FIGURE 7. FRF BATHYMETRY 9 Sep 88
(Depths Relative to NGVD)

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